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Dated

5 August 2003

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GB 0218740.9

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

MICROGEN ENERGY LIMITED,  
100 Thames Valley Park Drive,  
READING,  
Berkshire,  
RG6 1PT,  
United Kingdom

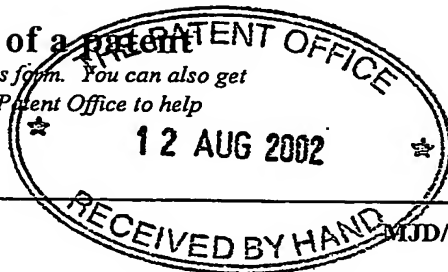
Incorporated in the United Kingdom,

[ADP No. 08474314001]

Patent Act 1977  
(Rule 16)

**Request for grant of a patent**

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The Patent Office

Concept House  
Cardiff Road  
Newport  
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1. Your reference MJD/60055/000

13AUG02 E740489-3 D02882  
POL/7700 0.00 0218740.9

2. Patent application number  
(The Patent Office will fill in this part)

**0218740.9**

**12 AUG 2002**

3. Full name, address and postcode of the or of each applicant (underline all surnames)

BG Intellectual Property Limited  
100 Thames Valley Park Drive  
Reading  
Berkshire  
RG6 1PT

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

GB

SECTION 30 (1977 ACT) APPLICATION FILED  
19/9/02

8201725001

4. Title of the invention A Wall Mounted Domestic Combined Heat and Power Appliance

5. Name of your agent (if you have one) BOULT WADE TENNANT

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

VERULAM GARDENS  
70 GRAY'S INN ROAD  
LONDON WC1X 8BT

Patents ADP number (if you know it)

42001

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day/month/year)
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7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? Yes  
(Answer 'Yes' if:  
a) any applicant named in part 3 is not an inventor, or  
b) there is an inventor who is not named as an applicant, or  
c) any named applicant is a corporate body.  
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# Patents Form 1/77

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Continuation sheets of this form -

Description 7

Claim(s) 2

Abstract -

Drawing(s) 2 + 2

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77)

Any other documents  
(Please specify)

11

I/We request the grant of a patent on the basis of this application.

Signature

Date

*Boris Wade Tennant*

12 August 2002

12. Name and daytime telephone number of person to contact in the United Kingdom  
Martyn J. Draper  
020 7430 7500

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A WALL MOUNTED DOMESTIC  
COMBINED HEAT AND POWER APPLIANCE

5 The present invention relates to a wall mounted  
combined heat and power appliance. The invention has  
been motivated by the need to improve the mounting of  
a combined heat and power appliance having a linear  
free piston Stirling engine. However, it can be  
10 applied to any wall mounted combined heat and power  
appliance where the prime mover generates undesirable  
vibration.

15 The linear free piston Stirling engine operates  
at a generally constant frequency and tends to vibrate  
primarily in a single direction, being the direction  
of reciprocation of the engine. Such vibrations can  
be substantially cancelled out by suspending an  
absorber mass from the engine on a spring (as  
disclosed in our earlier UK application No. 0203016.1.

20 Further, by suspending the engine on a number of  
low-stiffness springs, transmission of any resultant  
vibrations to the engine mounting can be reduced (see  
our earlier application 0203016.1).

25 The Stirling engine requires a seal between the  
vibrating Stirling engine and an externally mounted  
burner in order to prevent the burner gases from  
escaping into the housing and into the dwelling.  
30 Such a seal represents an interface between a  
vibrating component and a static component. The seal  
can be designed to be flexible in the direction of the  
reciprocation of the engine, but tends to be  
relatively stiff in the horizontal plane. Thus,  
35 vibrations in the horizontal plane of the engine and  
the absorber mass are not isolated from the appliance

casing. The vibrations are consequently transmitted to the wall, causing the wall to vibrate, and exciting resonances in the wall and other structures. These resonances are the major cause of unacceptable vibration problems on prototype units which we have tested to date.

The present invention aims to solve this problem.

According to the present invention, a wall mounted domestic combined and power appliance comprises a prime mover to generate electrical power and heat output, a housing containing the prime mover and at least one bracket at each side of the housing to mount the housing to a wall, each bracket comprising a main body which is elongate in a vertical direction and has an L-shape section, each extremity of the L-shape cross section having an enlarged portion, a first of which provides a spacer between the main body and the housing, and a second of which provides a spacer between the main body and the wall.

This bracket arrangement has the necessary vertical rigidity to support the weight of the prime mover (and any associated absorber mass). However, the bracket also provides the necessary flexibility in the horizontal plane, both in direction towards and away from the wall (subsequently referred to as the in/out direction), and the direction parallel to the wall subsequently referred to as the left/right direction). The presence of the two enlarged portions provides sufficient clearance to allow this vibration in the horizontal plane. The brackets greatly reduce or eliminate the transference of horizontal vibrations to the wall.

A single bracket may be provided on each side of

the housing. However, the current preference is to provide two such brackets on each side of the housing spaced in the vertical direction. More than two brackets could also be provided.

5

As previously mentioned, the present invention is particularly applicable to a linear free piston Stirling engine, and particularly, to one from which an absorber mass is suspended to reduce vibrations in the vertical direction.

10

With any domestic combined heat and power appliance of this type, several other connections to the outside world are required. For example, it may require a supply of combustible gas, a supply of air to a burner and an outlet for exhaust gases from the burner. In addition, to extract the heat, the unit may require an inlet for cold water and an outlet for heated water.

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The housing is, therefore, provided with flexible inlet/outlet fluid connections.

Such a connection may for example, take the form of an inlet/outlet pipe extending through an oversize hole in the housing, with a flexible seal between the hole and the pipe. Preferably, two such flexible seals are provided internal to the housing and one external to the housing respectively. The presence of at least one flexible seal ensures that the pipe is centred within the hole, prevents the pipe from making direct contact with the housing, prevents transmission of noise through the clearances and allows thermal expansion of the casing.

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The liquid pipe, in particular, can serve to transmit pressure pulses. To reduce these, each pipe

is preferably provided with a flexible section to absorb the pressure pulses. Preferably, such flexible sections are bellows sections.

5        Examples of an appliance in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

10        Figure 1 is a schematic diagram of the connections between the appliance and the outside wall;

15        Figure 2 is a schematic perspective showing the lid of the wall mounting in brackets;

      Figure 3 is a more detailed diagram of the appliance as shown in Figure 2; and

20        Figure 4 is a cross-section through a fluid connection to the appliance.

25        The DCHP unit comprises a linear free piston Stirling engine, from which an absorber mass is suspended in order to absorb vibrations in the direction of linear motion. Such a unit is described in greater detail in our earlier application 0203016.1. The detailed construction of the engine is not of concern in the present invention.

30        The engine is mounted within a housing 1 on a frame (not shown) on a plurality of low stiffness springs (not shown) is disclosed in GB 0203016.1. This reduces the level of vertical vibration to a manageable level. However, the seal between the  
35        burner and the engine head is relatively stiff, and tends to transmit vibrations in the horizontal plane from the engine head to the burner assembly and hence



to the unit housing.

As shown in Figure 1, the engine as required to have a number of connections with the outside world. 5 Wall mounts 2 are provided to mount the engine and this will be described in greater detail with reference to Figures 2 and 3. The Stirling engine burner requires a combustible fuel inlet 3 and air intake 4. An exhaust gas outlet 5 is also required to 10 transmit the exhaust gas from the burner. In practice, the air intake 4 and the exhaust gas outlet 5 will be concentric to pre-heat incoming air.

An inlet 6 and an outlet 7 for the circulation of 15 the water to/from the domestic water heater or central heating are required.

The air intake 4 and exhaust gas outlet 5 for the burner are both connected to a recuperator which sits 20 above the Stirling engine and hence does not vibrate. Therefore this concentric arrangement simply requires a rubber concertina seal to seal to a respective housing, to ensure that the concentric flue is spaced from and generally centred within a hole within the 25 housing, so that it does not receive any vibration from the housing itself.

The fuel inlet 3 is connected to the burner housing and therefore is caused to vibrate with the 30 burner housing. For this reason, an arrangement such as that shown in Figure 4 is provided. In this arrangement, the fuel inlet 3 extends through in an oversize hole in the form of a housing formed by a short length of tube 8. The tube 8 is sealed at its 35 top and bottom end with a rubber boot 9 which holds the fuel inlet 3 away from the tube 8 and ensures that vibration of the inlet pipe is not transmitted to the

housing. The space between the pipe 3 and tube 8 may be filled with compliant noise attenuation material.

5       The water inlet/outlets 6, 7 are also in contact  
with a vibrating part of the engine, and a similar  
arrangement is used to isolate pipes 6, 7 from the  
housing 1 as described above with reference to the  
fuel inlet 3. In addition to the features described  
with reference to the gas inlet, the water inlet and  
10       outlet are also provided with two bellows sections 10  
and which are designed to reduce pressure pulses in  
the liquid thereby minimising their transmission  
downstream.

15       Access to the housing 1 is required for  
maintenance purposes as indicated by arrow 11. Such  
access is provided by a replaceable panel with a  
rubber edge seal. This is designed to allow the easy,  
secure replacement of the panel while minimising the  
20       risk of introducing leaks each time it is removed.

      The wall brackets 2 are shown in greater detail  
in Figures 2 and 3. As shown in Figure 2, the housing  
1 is supported by four brackets 2 with two brackets  
25       being positioned on each side of the housing 1 and  
being vertically displaced from one another.

      The brackets have a generally L-shape cross  
section shown in greater detail in Figure 3. The L-  
30       shaped cross section comprises a first side 20  
parallel to the wall W, and a second side 21 extending  
away from the first side 20 perpendicular to the wall  
W. The first side 20 is spaced from the wall W by an  
enlarged portion 22 which extends from the first side  
20 towards the wall W. Similarly, the second side 21  
35       is spaced from the housing 1 by an enlarged portion 23  
which extends from the second side 21 towards the

housing 1.

5       The wall brackets are designed to give a natural  
frequency of 20 Hz. To ensure this, the lateral  
stiffness is 12,000 N/m (+/- 1000 N/m). Aluminium  
brackets are used, which, for the arrangement  
incorporating 4 brackets, are of length 225 mm and  
edges of 100 mm each. The material thickness is 1.5  
mm. Dimensions for alternative arrangements, using  
10 different numbers of brackets, would reflect the  
required stiffness.

As will be appreciated from Figures 2 and 3, the  
brackets 2 provide adequate stiffness in the vertical  
15 direction allowing the vertical load of the Stirling  
engine and absorber mass to be adequately supported.  
However, as will be apparent from Figure 3, any  
vibrations in the horizontal plane are accommodated by  
the flexibility of the brackets 2, as well as the  
20 clearances which are provided between the sides 20 and  
21 of the brackets and the housing 1 and wall 2  
respectively by the enlarged portions 22 and 23.

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CLAIMS

1. A wall mounted domestic combined heat and power  
appliance comprising a prime mover to generate  
5 electrical power and heat output, a housing containing  
the prime mover, and at least one bracket at each side  
of the housing to mount the housing to a wall, each  
bracket comprising a main body which is elongate in a  
vertical direction and has a L-shape cross section,  
10 each extremity of the L-shape cross section having an  
enlarged portion, a first of which provides a spacer  
between the main body and the housing, and a second of  
which provides a spacer between the main body and the  
wall.  
15
2. An appliance according to claim 1, wherein a  
plurality of brackets are provided at each side of the  
housing.
- 20 3. An appliance according to claim 1 or 2 wherein  
the prime mover is a linear free piston Stirling  
engine.
- 25 4. An appliance according to claim 3, wherein an  
absorber mass is suspended from the Stirling engine.
- 30 5. An appliance according to any one of the  
preceding claims wherein the housing is provided with  
at least one flexible inlet/outlet connection for  
fluid.
- 35 6. An appliance according to claim 5, wherein the  
flexible connection is provided by an oversize opening  
in the housing through which an inlet/outlet pipe  
extends, and a flexible seal between the hole and the  
pipe.

7. An appliance according to claim 5 or claim 6,  
wherein the inlet/outlet is provided with a flexible  
pipe section to absorb pressure pulses.

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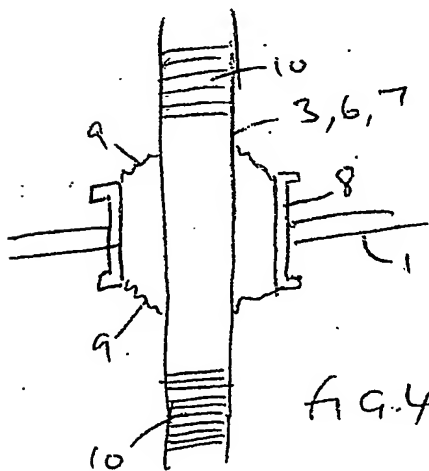
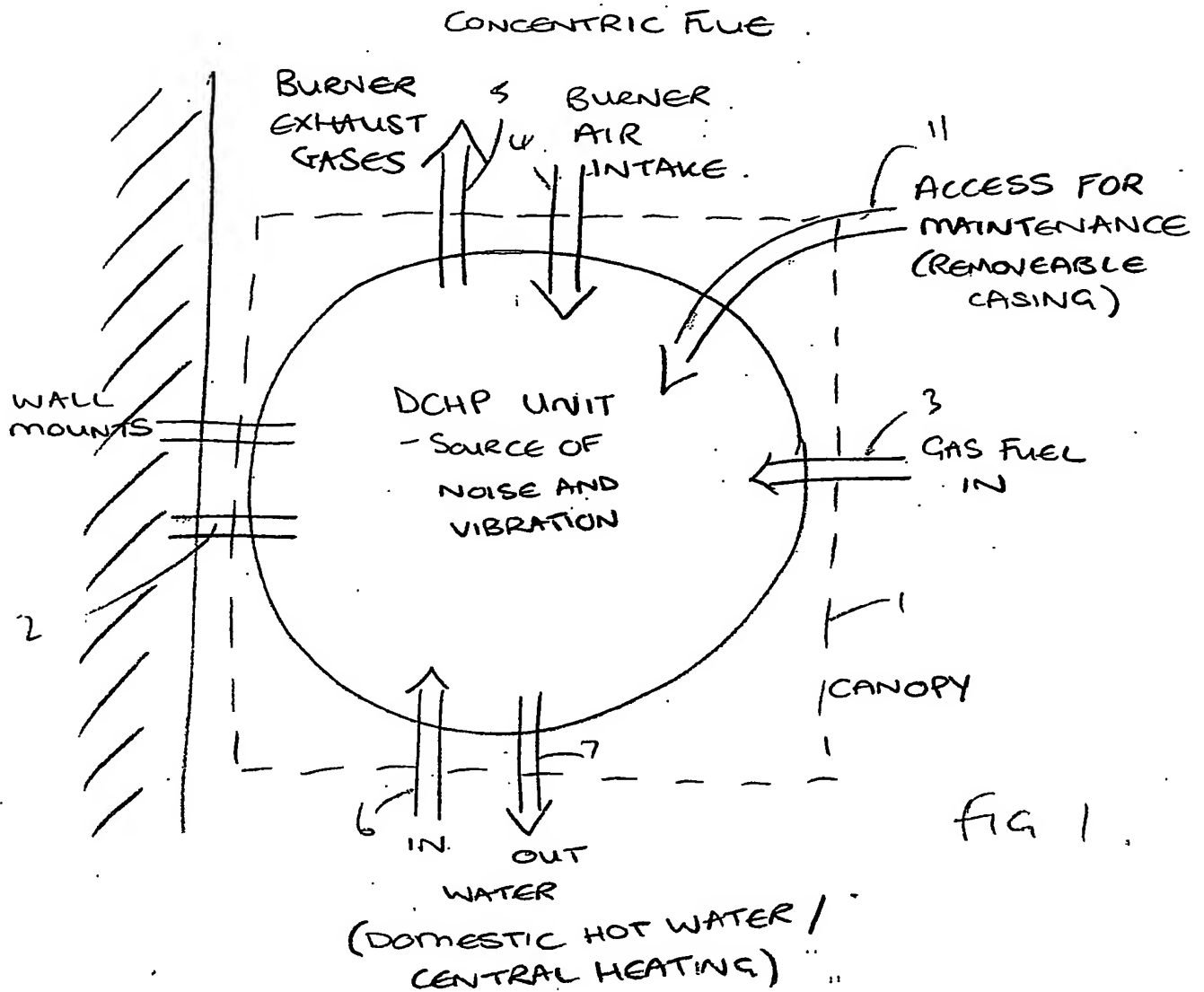
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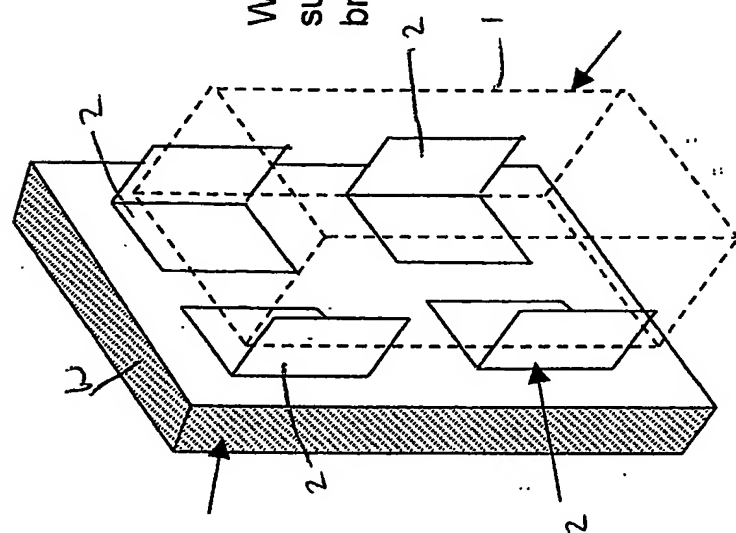
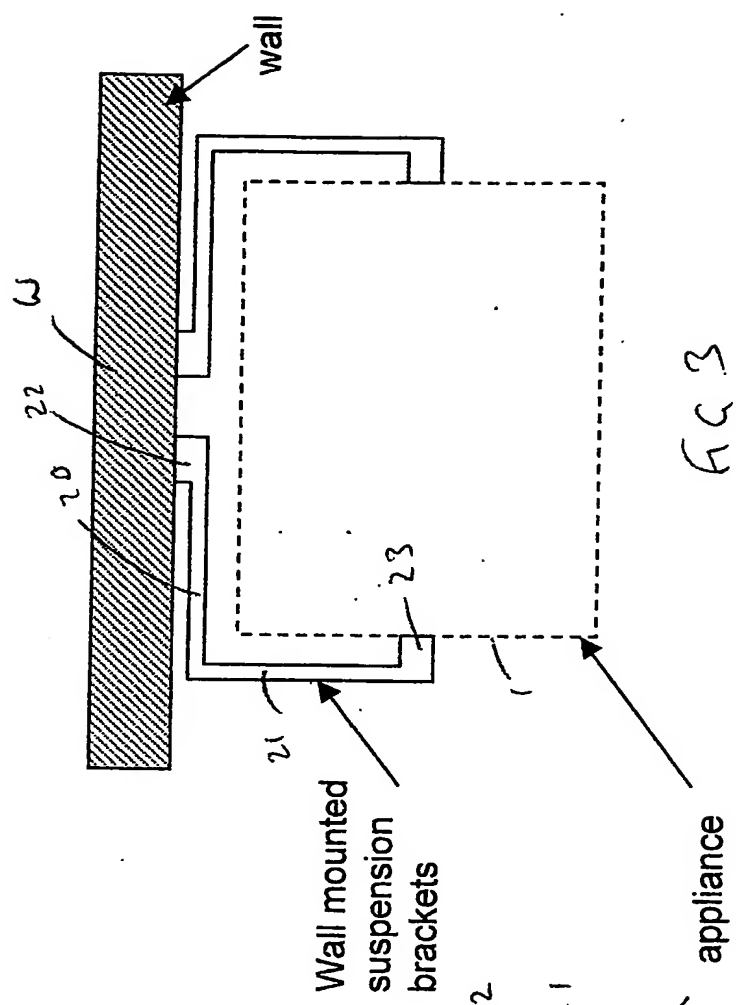
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Figure 1. Domestic Combined Heat and Power Unit External Interfaces





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PCT Application

**GB0303516**





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